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# UAVs in Humanitarian Relief and Wider Development Contexts

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## Question

*What uses have UAVs had in humanitarian relief and wider development contexts? Are there potential future uses within a development context that have been identified from other non-development industries?*

## Contents

# 1. Overview

The use of Unmanned Aerial Vehicles (UAVs, commonly referred to as drones) is no longer purely the domain of the military and new uses are constantly being developed. In humanitarianism and development the utilisation of UAVs is still a relatively new concept, which initially emerged from the UAV industry's need for legitimacy. However, in this rapidly developing field their importance and range of purposes is growing daily. Nonetheless, UAV usage is still not widespread as most of the projects are still in the concept and testing phase, with the exception of mapping which been used by NGOs across the globe. Moreover, UAV projects in humanitarianism and development are confined to small, short-range UAVs, as price and lack of access to technologies make larger long-range UAVs difficult to access (Soesilo et al., 2016).

Despite the benefits and capabilities of UAVs, there are a number of criticisms of their use. Many of these criticisms are linked to their origins as tools of war, the perceived technological colonisation of the Global South, and the use of humanitarianism to develop and market technologies for commercial use. These criticisms may die down as the everyday use of UAVs grows and interaction with them becomes normalised. However, issues to do with privacy and data protection are likely to expand with the increased use of UAVs.

This rapid review synthesises the literature on the use of UAVs in humanitarianism and development, whilst highlighting the potential future uses that have been flagged in the literature. It must be noted, however, that due to the rapid development of this technology and the secretiveness that is often paired with commercial developments it is difficult to create a complete and up-to-date list of the uses and developments of UAVs.

# 2. Types of UAVs

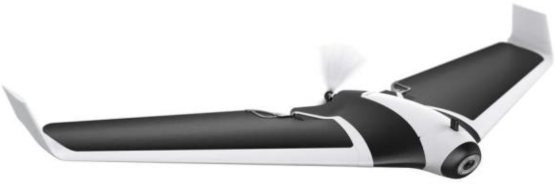
There are three main types of UAVs used in humanitarian and development settings: fixed-wing, multi-rotor, and hybrid UAVs (Samsioe et al., 2017; Soesilo et al., 2016). The UAV chosen depends on the specific task, conditions, regulations and budget, as each one has it limitations and benefits (Samsioe et al., 2017).

## Fixed-wing

Fixed-wing UAVs resemble a small plane and have two wings. They cover longer distances and can carry heavier payloads than the other two types. Fixed wing UAVs can usually travel at speeds of around 100 km/hour, operate in winds up to 50 km/hour, make round trips of roughly 150 km (this will increase as solar-powered UAVs develop), and can carry a pay load of up to 4.5 kg (although many can only carry 1.5kg). However, they cannot take off or land vertically and usually need a long runway,[1] which means they are not suitable for picking up samples and are more suited to parachuting/dropping supplies (Samsioe et al., 2017).

[1] Zipline uses fixed-wing UAVs, but utilise a catapult system for takeoff and recovery system to catch the deployed tail hook of the UAV for landing, thus countering the need for a large runway. See: http://flyzipline.com/now-serving/

**Image 1: Fixed-wing UAV**

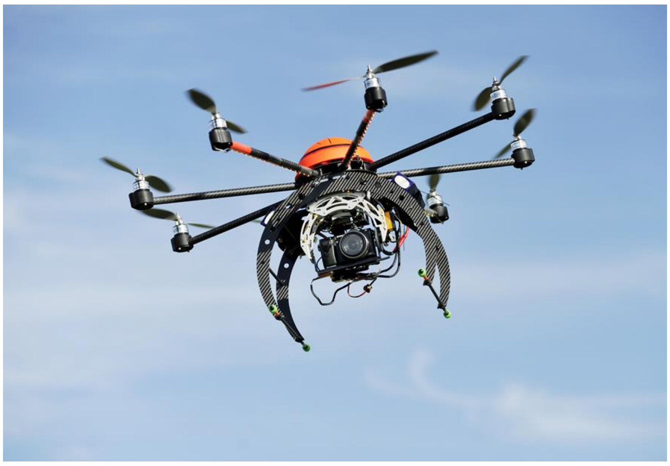


Source: http://gadgetynews.com/parrot-disco-drone-plane-uk-price-release/

## Multi-rotor

Multi-rotor UAVs can have one rotor (helicopter), four rotors (quad-coptor), or up to eight rotors (octo-copter), with the quad-coptor being the most commonly used. They can only travel shorter distances of up to 20km round trips with a load of up to 2kg. Their ability to take off and land vertically allows them to pick up and deliver goods, making them ideal for delivering and picking up samples. The operational distance can also be increased through creating a network with replacement batteries at designated posts (Samsioe et al., 2017).

**Image 2: Multi-rotor UAV**

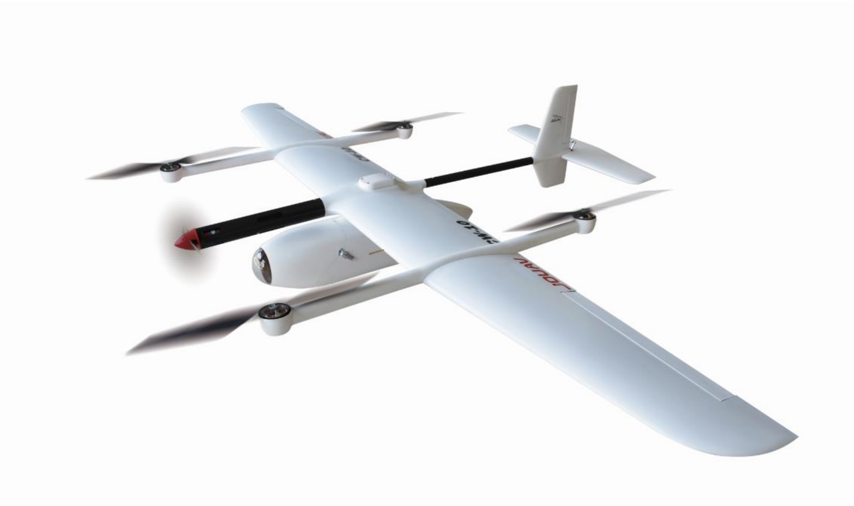


Source: https://upload.wikimedia.org/wikipedia/en/b/b7/Coptercam8_aerial_camera_system.jpg

## Hybrid

Hybrid UAVs have both wings and rotors, allowing for vertical take-off and landing, as well as horizontal flight. This enables for them to cover long distances and carry (relatively) heavy cargo. However, they are a new concept and are not as far in development as fixed-wing and multi-rotor UAVs (Samsioe et al., 2017).

**Image 3: Hybrid UAV**



Source: https://www.suasnews.com/2016/06/44305/

**Table 1: Comparisons of UAVs for delivery**

| | Fixed wing | Multi-rotor | Hybrid |
|---|---|---|---|
| **Range** | Up to 160 km | About 20 km | About 80 km |
| **Payload** | Up to 5 kg | Up to 2 kg | Up to 5 kg |
| **Launch** | Catapult | Vertical | Vertical |
| **Variations** | Gas or electric | Gas or electric | Gas or electric |
| **Advantages** | • Long range<br>• More efficient<br>• Heavier payloads than multi-rotor<br>• More stable flying<br>• Well established concept with the weight of aerospace engineering behind it | • Maneuverability in small spaces<br>• Vertical takeoff and landing<br>• Generally cheaper<br>• Can fly with a minimum of two rotors | • Vertical take-off and landing but with comparable range to fixed wing<br>• More options for landing and take-off sites<br>• Heavier payloads than multi-rotor<br>• Easier for "safe" emergency landings |
| **Disadvantages** | • Large space required for take-off and landing (no VTOL)<br>• Limited maneuverability in small spaces<br>• Emergency landings are generally less easy to control | • Low payload limit<br>• Generally more complex designs (high software requirements to keep in the air) requiring expert maintenance and trained staff at health centers<br>• Limited range<br>• Inefficient in some settings | • Generally more expensive<br>• Neither as long range as fixed wing nor as maneuverable as multi-rotor |
| **Manufacturers** | • Zipline<br>• Wings for Aid<br>• UAVaid | • Matternet<br>• Flirtey<br>• Microdrones | • Amazon<br>• Google<br>• DHL<br>• Drones for Development - Dr. One.<br>• Quantum Systems<br>• Vayu |
| **Example of Users** | • Government of Rwanda<br>• MOAS | • MSF<br>• World Bank<br>• UNICEF<br>• Swiss Post | • MSF (planned)<br>• We Robotics (planned) |

Source: Samsioe et al., 2017: 13.

# 3. UAVs in Humanitarian and Development Contexts

The development of UAVs for humanitarian assistance is a relatively new field, however it is developing quickly and expanding into multiple areas of use (Samsioe et al., 2017; Soesilo et al., 2016). Currently, small or mini-sized devices with a limited flight range are predominantly used, as large, long-range UAVs are prohibitively expensive. However, this should change as the expansion of the market leads to cost reductions in production (Soesilo et al., 2016).

In their seminal report on the use of drones in humanitarian settings, Soesilo et al. (2016:7) argue that the most promising uses of UAVs include:

- Mapping
- Delivering lightweight essential items to remote or hard- to-access locations
- Supporting damage assessments
- Increasing situational awareness
- Monitoring changes.

Whilst Samsioe et al. (2017: 11) highlight that 'UAVs have the potential to improve access to essential medicine in hard-to-reach areas, speed up transportation of medicine and medical supplies, provide access to faster diagnostic services, and complement existing health supply chains'. Moreover, UAVs can also help reduce the need for forecasting, as deliveries can quickly and easily be requested.

This section focuses on exploring these multiple uses and developing an understanding of the role UAVs are beginning to play in both the humanitarian and developmental spheres.

## Mapping

According to Soesilo et al. (2016) mapping is the most common form of UAV usage in the humanitarian sphere. The International Organisation for Migration (IOM) pioneered UAV usage following the 2010 earthquake in Haiti. IOM used UAVs to map the densely populated urban areas of Port-au-Prince, particularly the slums where satellite imagery was not accurate enough. These maps were used for a census to clarify land tenure status. The maps allowed staff to pinpoint the buildings to assess, and to link the buildings to their owners.[2]

UAVs were also used to map and model flood risks in a World Bank supported project in Dar es Salaam, Tanzania, where over 70 percent of the population live in informal, unplanned settlements. The project created exposure maps of the affected communities and a hydrological model using elevation data, which were both used to manage flood risks (Soesilo et al., 2016).[3]

[2] http://drones.fsd.ch/en/case-study-no-7-using-high-resolution-imagery-to-support-the-post-earthquake-census-in-port-au-prince-haiti/

[3] http://drones.fsd.ch/en/case-study-no-1-mapping-flood-mapping-for-disaster-risk-reduction-obtaining-high-resolution-imagery-to-map-and-model-flood-risks-in-dar-es-salaam/

For small areas UAVs offer high quality detailed maps (image resolution ranges from 3.5 to 8.0 cm) at an affordable price. However, for larger areas helicopters or small planes are often used, whereas satellites offer lower resolution maps of larger areas still. Besides resolution, UAVs also have the advantage over satellites of being able to operate under cloud cover, thus allowing for a more rapid response time. Nonetheless, data processing does take time, especially for larger high-resolution projects. To counteract the time it takes to process such a large amount of data, many projects use a number of online volunteers to process the data (Soesilo et al., 2016).

UAVs are also used for emergency response mapping immediately following a disaster. However, this is not yet widespread, as in order to be effective, organisations with the tools and knowledge have to already be on the ground. When these capabilities are present, UAVs are able to provide a rapid assessment of damages, which can be used to coordinate responses (Soesilo et al., 2016).

## Deliveries

UAVs for deliveries have not yet reached the developmental stage of those for mapping, and off the shelf options are not available. However, due to the interest in this technology outside of the humanitarian sphere there is significant investment and developments are happening rapidly. For humanitarian purposes there is a focus on utilising UAVs for the delivery of life-saving goods, mainly medical, to hard to reach areas. Currently commercially available UAVs cannot compete with planes or helicopters when it comes to humanitarian aid because they cannot travel the same distance nor carry heavy loads. Although this technology is under development, at the moment usage remains confined to small valuable cargo loads (mainly in pilot projects), which is why medical supplies/samples are currently the main focus for humanitarian agencies. A number of trials have been carried out, ranging from transporting Tuberculosis sputum samples in Papua New Guinea to HIV tests in Malawi. Even so, this technology is still being developed further to increase the range and cargo load capabilities of the UAVs and significant advances are expected over the coming years (Soesilo et al., 2016).

Zipline is considered to be one of the most advanced actors in cargo delivery in the humanitarian/development setting (Soesilo et al., 2016). Using fixed winged UAVs with a range of 75km and the capability of carrying a load of up to 1.5kg, in a commercial project in collaboration with the Rwandan government, Zipline delivers blood to remote hospitals 24/7 with a rapid response time.[4] Through Zipline blood is currently delivered in less than 17 minutes following an order from a doctor on a smart phone, drastically decreasing the previous round trips to collect blood that took roughly four hours. Although Zipline only delivers blood in Rwanda, they plan to diversify to include: rabies vaccines; drugs to treat HIV, tuberculosis, and malaria; contraceptives; and diagnostic test kits. It is still considered too early to evaluate the impact and costs of Zipline (Rosen, 2017). However, a study on vaccine-delivering UAVs in Mozambique carried out by the Johns Hopkins Bloomberg School of Public Health found that UAVs provide between 20 to 50 percent cost savings over traditional land-based transport in vaccine delivery in the country (Lee, 2017; Haidari, L. A. et al. 2016).

An issue with UAVs for delivery purposes is that drone regulations often do not include provisions for cargo delivery. The regulations that do permit cargo delivery often do not allow for the cargo to be dropped or parachuted, which are the preferred methods. A further regulatory

[4] http://flyzipline.com/now-serving/

issue is that operators are supposed to maintain visual contact with the UAV at all times. As UAVs develop further and regulations change it is thought that some of these obstacles will be removed or overcome (Soesilo et al., 2016).[5]

## Search and Rescue

Drones are increasingly being developed for the use in search and rescue missions and the EU-funded Integrated Components for Assisted Rescue and Unmanned Search (ICARUS) project has developed a number of technologies to detect, locate and rescue people. The ICARUS project has focused on developing and testing UAVs (as well as ground and water vehicles) for disasters. The UAV used in their project (LIFT IV) includes an on-board computer, stereo vision-inertial sensor, thermal imager and a survival kit delivery mechanism – allowing for automatic detection of victims, obstacle avoidance, fast mapping and 3D reconstruction (Marques, et al., 2016).

In March 2017, DJI,[6] a UAV technology company, released a report examining the use of UAVs in search and rescue. Through an analysis of media reports they concluded that:

- At least 59 lives have been saved by civilian drones in 18 different incidents around the world
- 38 of those lives were saved in the last 10 months
- Based on the results, drones are currently saving almost one life a week on average
- 20 of those lives (38%) were saved by civilian drones using their drone to assist in a rescue scenario
- 31 lives were saved during floods as drones spotted missing persons and in some cases delivered a life vest or rescue rope (DJI, 2017).

UAVs in search and rescue are still very much in the developmental stage, are not widely available to emergency services, and often bystanders with UAVs assist. However, those who have begun using UAVs have found them successful in a number of uses from locating victims to delivering aid, to protecting the emergency service members (DJI, 2017).

## Monitoring Changes

There is very limited use of UAVs for monitoring in the humanitarian sphere, however Soesilo et al. (2016: 50) argue that their usage would allow for the assessment and monitoring of large areas. In particular they could be used to:

- Identify and track displaced populations, their movements and temporary settlements

- Make large-scale assessments of a selected region or assess remote and difficult-to-reach areas

[5] Regulations of UAVs are an issue for their usage in multiple contexts, which is one of the reasons that many of the tests are happening in the developing world. However, these regulations are changing and catching up with the industry. For country-by-country overview of regulations, see: https://www.droneregulations.info

[6] It must be noted that they are a commercial enterprise with a vested interest in marketing UAVs as being lifesavers rather than life takers.

- Monitor logistics convoys in real time.

One example of UAVs used for monitoring changes is following Typhoon Haiyan in the Philippines in 2013. Here a UAV was used to provide an aerial view of roadways and damaged buildings. For instance, a hospital that was unreachable due to the storm was assessed for damage using a UAV, thus allowing the team to locate and transport the correct materials for repair.[7] Similarly, following the 2008 Sichuan earthquake in China UAVs were used to locate downed bridges and collapsed tunnels, as well as to asses the damage to schools and hospitals, which helped in the planning for rescues and reconstruction (Maxey, 2017).

IOM also used UAVs for monitoring and managing camps for Internally Displaced People (IDPs) in Haiti following the 2010 earthquake. The imagery produced by the UAVs was used to delimit the extent of the camp and then to count and identify the tents in the camp. This was then used to establish camp size, organise the camps into zones, and inform decision-making (such as planning construction based on needs) (Soesilo et al., 2016).[8]

## Public Health Prevention

There are a number of projects where UAVs are used to combat the spread of disease from mosquitoes (Zika) and Tsetse flies (trypanosomiasis) through sterile vectors (Samsioe et al., 2017).

In Ethiopia UAV-maker Embention partnered with the International Atomic Energy Agency (IAEA), the Ethiopian Ministry of Livestock, and the United Nations Food and Agricultural Organisation (FAO) in a project to reduce the population of Tsetse flies. The project uses UAVs to release large numbers of sterilised male tsetse flies into the wild, which acts to reduce the total population.[9] The Use of UAVs allows for more precise delivery of the sterile flies and at a cheaper price than small aircrafts. The aim of the project is to claim back land for agriculture and human habitation, which is currently unusable due to the Tsetse fly.[10]

Similarly, WeRobitics in partnership with the joint FAO/IAEA Insect Pest Control Lab and with a USAID grant is carrying out a test project in Peru to deliver sterile mosquitoes to combat the spread of Zika. Studies show that releasing sterile mosquitoes can reduce the overall mosquito population in a given area by 90%, thus limiting the spread of the virus.[11]

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[7] http://drones.fsd.ch/en/case-study-no-9-using-drone-imagery-for-real-time-information-after-typhoon-haiyan-in-the-philippines/

[8] http://drones.fsd.ch/en/case-study-no-8-high-resolution-uav-imagery-for-camp-management-in-haiti/

[9] The sterile insects mate with the original population, producing no offspring and consequently reducing the population.

[10] https://uav-development.github.io/case-studies.html#ethiopia

[11] https://irevolutions.org/2017/06/13/how-to-reduce-zika-with-robots/

In Guatemala UAVs have been used to identify and map breeding sites of Aedes mosquitoes that transmit diseases such as Zika and dengue. The maps are used for the targeted application of larvicides at breeding sites and to identify the specific risk conditions for individual villages.[12]

In Borneo, the London School of Hygiene and Tropical Medicine are using UAVs to map malaria-affected communities and surrounding areas in order to understand why the malaria parasite, Plasmodium knowlesi, which is commonly found in monkeys, is now infecting humans. The project uses the maps created from UAVs, along with GPS data from humans and monkeys, to understand the change in behaviour and where humans and monkeys are crossing paths.[13]

## Agriculture

UAVs are beginning to play an important role in agriculture as they have multiple uses, such as: monitoring crops or livestock, planning planting, making rapid assessments of crops needs, estimating yields and damage, fending off pests, surveying fencing, assessing land tenures, precision crop spraying, etc. (Greenwood et al., 2016).

For instance, in Sri Lanka the International Water Management Institute (IWMI) uses UAVs with infrared sensors to detect fields that are under stress and identify low-laying areas prone to pooling. Whilst in Tanzania, UAVs have been used in a test project of sweet potato crops. In this study, aerial, multispectral images were used to identify which plants were thriving or stressed by drought, nutritionally deficient, or under attack by insects or a virus. In Kenya and Ghana the University of Lund and the Swedish University of Agricultural Sciences are testing UAVs to estimate crop yields of maize farms. Although still in the early stages of development, this project is being used to help farmers understand their fields and crops to improve their farming practices (Greenwood et al., 2016).

In Panama indigenous communities, with the support of the Rainforest Foundation US and Tushevs Aerials, have begun using UAVs to monitor their lands and report illegal logging and burning of rain forests for cattle grazing. Prior to the use of UAVs the indigenous communities were not able to accurately document the scale of deforestation to report to the authorities to request action - due to the size of their territories and the often-armed actors involved in deforestation. As a result, they have successfully been able to get the authorities to increase patrols in specific areas. Due to the success of the project, the Rainforest Foundation US and FAO aim to expand it to more communities (Greenwood et al., 2016).

## Monitoring Climate Change

Ohio State University is using UAVs to monitor the impact of climate change on glaciers and wetlands in Peru. Using UAVs with thermal cameras, researchers are able to identify which parts of the glacier are melting fastest and where the melted ice is going. The researchers are also tracking the rate at which the glaciers are melting. All this information is used to help local communities plan their water management as the planet warms.[14]

[12] https://uav-development.github.io/case-studies.html#guatemala

[13] https://uav-development.github.io/case-studies.html#borneo

[14] https://uav-development.github.io/case-studies.html#peru

## Demining

Although still in the early stages of development UAVs are being tested and developed to detect potential mine fields and in some cases even to demine areas (Samsioe et al., 2017).

In Bosnia and Herzegovina floods and landslides shifted mines into inhabited areas. As part of the response UAVs were used to conduct aerial surveys of flooded, mine-affected areas. The results were then used to identify where the mines were likely to have shifted to and to survey areas too dangerous to enter by foot.[15] In the EU-funded TIRAMISU project, which was also involved in the above test in Bosnia and Herzegovina, UAVs are being developed and tested to detect mines, sub-munitions or explosives at close range.[16] Finally, in a commercial start-up, Mine Kafon Drone (MKD), UAVs that have the capability to map, detect and detonate mines are being developed. The UAV first maps the desired area, then uses a metal detector to detect and flag mines, the UAV then swaps its metal detector for a robot arm and places detonators over the mines' locations, it then retreats to safety and the mines are detonated. However, this project is still very much in the developmental stage (Vincent, 2016).

## Protecting Civilians and Peacekeeping

The UN first experienced the use of UAVs in 2006 in the Democratic Republic of Congo (DRC) when Belgian troops brought UAVs for aerial surveillance. However, one UAV was shot down and another crashed killing one person and seriously injuring many others. Also in 2006, the UN used UAVs to monitor transborder activities of armed groups along the Sudanese borders with Chad and the Central African Republic. In 2009, following the invasion of Chad by opposition forces from Darfur, the UN used UAVS to monitor the movement of forces and in the protection of refugees, IDPs, and humanitarian aid workers (Karlsrud and Rosén, 2013).

However, according to Karlsrud and Rosén (2013:2) the defining moment for the use of UAVs for the UN was in the DRC in 2013, when the use of UAVs significantly increased under a wide mandate for action. With photographic and infrared capabilities, UAVs were used to detect hidden troops, track movements of armed militias, assist patrols in hostile territories, and document atrocities. However, due to the history of UAVs, there is much skepticism within the UN about their use, mainly revolving around concerns about use of intelligence and targeted killings.

For Karlsrud and Rosén (2013) UAVs can help monitor potential spoilers – such as the movement of armed groups in relation to the local population – before using force, and to record incidents where peacekeepers are using force to protect civilians. Thus, helping with the accountability of peacekeeping. However, they go on to argue that UAVs are:

> not a panacea for the challenges facing UN peacekeeping missions. In fact, as we have pointed out, they may well add to the complexity, and thus the challenges, faced by UN peacekeeping operations - by establishing higher standards as to when and how force is applied and requiring documentation at all times in case civilian casualties should occur (Karlsrud and Rosén, 2013: 10).

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[15] https://uav-development.github.io/case-studies.html#bosnia

[16] http://fp7-tiramisu.eu/project-overview/tiramisu-modules

# 4. Wider Industry and Future Uses

UAVs are developing at a rapid pace and there are a number of concepts that are being explored and developed for the humanitarian and development sphere. Additionally, there are multiple commercial developments and concepts that could be used in humanitarianism and development in the future. This section aims to explore the developments and future uses that have been highlighted in the humanitarian and developmental literature.

Currently humanitarian and development organisations only use small short-range UAVs for transport, and even this is at a limited scale. This is largely due to the technology for long-range large UAVs being mainly in the military domain. However, companies such as Boeing, Lockheed Martin, and Northrup Grumman are developing the technology, it could therefore enter the civilian domain in the near future and potentially have a role to play in aid delivery. A potential obstacle to its use by humanitarian organisations is that the price is likely to remain high for some time (Samsioe et al., 2017). Additionally, there are a number of commercial enterprises – such as Google, DHL and Amazon – developing UAVs for package delivery, which are likely to increase the capacity and capabilities of the technology, which could impact the humanitarian and development spheres (Samsioe et al., 2017).

Commercially UAVs are also being developed for Internet provision, as well as for temporary phone networks. Once this technology is commercially available there is the potential to use it in the humanitarian and development spheres (Soesilo et al., 2016). Facebook is developing and testing a solar-powered UAV called Aquila with the aim of providing Internet access to remote areas (Guardian, 2017). Whereas Google is developing and testing solar UAVs that use millimetre-wave radio transmissions capable transmitting up to 40 times more data per a second than current 4G LTE technology (Harris, 2016).

The commercial developments from companies such as Amazon, Google and Facebook are likely going to lead to a significant increase in people’s interaction with UAVs on a daily basis. As this use increases and UAVs begin to be associated with these companies, a normalisation of their usage will likely occur and the negative connotations they have as killing machines will begin to reduce. This in turn will open up their usage to more situations in humanitarianism and development, and will increase the acceptance of UAVs among NGOs and the populations they serve (Karlsrud and Rosén 2013).

UAVs are also currently being developed to help deal with deforestation, countering the systematic destruction with systematic planting.[17] Pilot projects involve using UAVs to map the zone for planting, create a seeding plan, plant seeds, and then monitor their growth. Through using UAVs the aim is to replant large areas far more quickly than current methods and then to ensure adequate reforestation.[18]

The uses of UAVs discussed in this report are constantly being developed further and becoming more widely available. Additionally, there are a number of concepts that have developed from the

[17] https://irevolutions.org/2017/06/13/how-to-reduce-zika-with-robots/

[18] http://www.biocarbonengineering.com/technologies

initial pilot studies in humanitarianism and development. For example, the use of UAVs in development and agriculture have led to the concept of using UAVs to target locust swarms, which is currently being developed by FAO. The idea is to utilise UAVs to survey territory and spot locust swarms, UAVs could then be used to administer pesticides directly onto the locust concentrations, and to monitor the area. UAVs could also be used to check for locusts in areas that are insecure or cannot be accessed by ground teams (Greenwood et al., 2016).

Although UAVs are already being used for medical deliveries this technology is rapidly developing and with improvements their use and capabilities will increase. The use is currently limited due to issues with battery life and low payloads. However, current developments with solar power and docking stations will eventually overcome these limitations. Additionally, as the technology develops UAVs could be used in more complicated medical contexts. For instance, to respond to highly contagious viruses that require quarantine, as home-quarantine could be used whilst UAVs send samples for testing (Samsioe et al., 2017). UAVs may also be used to deliver defibrillators to patients suffering from cardiac arrest. This has already been tested in Sweden where test flights and a model using a Geographic Information System (GIS) was used to examine the feasibility of delivering automated external defibrillators (AEDs) to out-of-hospital cardiac arrests (OHCAs) using UAVs. The test found that in 32 percent of urban cases the UAV arrived before the emergency medical service, and the mean amount of time saved was 1.5 minutes. In rural OHCAs, the drone arrived before emergency medical service in 93 percent of cases, with a mean amount of time saved of 19 minutes (Samsioe et al., 2017). There is also the idea, which has not yet been developed, that UAVs could be used to offer paramedics a tool to harvest and send organs wherever they are needed. Thus addressing the perishability of organs and the issues of matching a recipient with the same blood type, body size, and geographic location (Samsioe et al., 2017).

The list of possibilities for future uses of UAVs that are either in concept phase or development is endless, some of the relevant uses not discussed in this report are:

- Early warming systems that monitor atmosphere changes to predict hurricanes, earthquakes, Tsunamis, etc.
- UAVs that monitor animals to prevent poaching
- UAVs that act as bees for mass pollination
- UAVs that monitor air quality.[19]

# 5. Criticisms

Despite the growing use of UAVs in both humanitarianism and development and the continued inroads being made in the technology, there are a number of criticisms of their use, which will be discussed in this section.

Criticisms of the use of UAVs in the humanitarian sphere are particularly strong in conflict settings, as it is argued that they are likely to be confused with weaponised UAVs and military/intelligence operations. Critics thus argue that it would have a negative psychological impact on the population and could damage the reputation of the humanitarian organisations and

[19] http://www.futuristspeaker.com/business-trends/192-future-uses-for-flying-drones/

negatively impact their work (Soesilo et al., 2016). Karlsrud and Rosén (2013) counter this criticism by arguing that UAVs are being used more and more frequently for multiple, different purposes and the perception of them as purely military tools is changing.

Another criticism involves privacy and the ethical collection and use of data. UAVs capture high-resolution images, often in densely populated areas (Soesilo et al., 2016). Thus, the technology is infringing on people's privacy and it raises questions of who will have access to the data, how it will be used, and how privacy will be protected (Sandvik and Lohne, 2014; Karlsrud and Rosén 2013).

For Sandvik and Lohne (2014) the humanitarian UAV cannot be removed from its origin and should be viewed as a "war dividend" derived from military spending on the war on terror from which they were funded and perfected. Additionally, the military ties equate to political and lobbying links and the UAV industry is now trying to shape the political debate about civilian usage. Moreover, the humanitarian use of UAVs is used by the industry to gain legitimacy, as well as for expansion into new markets as military funding dries up, thus pointing towards financial rather than humanitarian motives (Sandvik and Lohne, 2014). Similarly, another criticism is that UAV companies (particularly those with military links) are using links with humanitarian organisations for good press and as part of a marketing campaign to change the perceptions of UAVs as 'killing machines' (Hofman and Whittal, 2016).

There is also a fear that the use of UAVs in humanitarianism may create distance between the responder and those in need, negatively impacting the process of aid. Additionally, Sandvik and Lohne (2014) argue that it could turn humanitarian responses into a new form of virtual reality for global audiences, which could eventually lead to less empathy for those affected. However, Karlsrud and Rosén (2013) argue that if used correctly UAVs can actually help bring peacekeepers closer to adversaries and civilians in need of protection.[20]

A more cynical criticism is that UAV companies and start-ups are using the humanitarian sphere as a site to develop technology for the Western markets. The accusations are that these companies are using the more lax restrictions in development contexts to perfect their technology. Thus, these companies are using these contexts to provide a proof of concept, gain a competitive advantage, and for marketing purposes (Samsioe et al., 2017). Sandvik (2015) argues that in order to counteract the negative perception of UAVs and increased regulations in the Global North, Africa is used by UAV companies to develop technologies and to obtain legitimacy as good technology. Furthermore, she questions whether UAVs are solving actual problems, or if they are just being marketed to. Sandvik and Lohne (2014) argue that due to humanitarian settings offering a site for development, UAVs are often a solution looking for a problem, rather than a solution to a problem.

Finally, there is the issue that UAVs are often envisioned as panacea for all the problems that currently attend relief provision, which ignores the multiple issues involved in aid delivery, including the risk to foreign policy objectives and the issues with the mission statements in the first place. This leads to the question of whether NGOs can actually afford to fund the development, operation, and purchasing of UAVs and whether these funds could be better spent elsewhere (Sandvik and Lohne, 2014).

[20] UAVs can be used to find civilians in need, find armed actors who are potentially going to target civilians, and to help workers negotiate safe passage to those in need.

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## Key websites

- FSD Drones: http://drones.fsd.ch/en/homepage/
- Drone Blog: http://droneblog.com
- iRevolutions: https://irevolutions.org
- UAViators: http://uaviators.org/docs
- UAV State of Play in Development: https://uav-development.github.io
- Global Drone Regulations Database: https://www.droneregulations.info

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## About this report

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